



# **2005 Electricity Environmental Performance Report: Electricity Generation and Air Emissions**

November 15, 2004

Matt Layton

California Energy Commission

[m Layton@energy.state.ca.us](mailto:m Layton@energy.state.ca.us)

916.654.3868



## Recent Air Emissions Analyses

- 2001 Environmental Performance Report
  - Trends of NO<sub>x</sub> and PM<sub>10</sub> emissions and rates -1975 to 2000, four major California regions
- 2003 Environmental Performance Report
  - Trends of NO<sub>x</sub>, PM<sub>10</sub>, and CO<sub>2</sub> emissions and rates -1996 to 2002, in-state and out-of-state
- 2004 Energy Report Update - Aging Power Plant Study
  - NO<sub>x</sub>, PM<sub>10</sub>, PM<sub>2.5</sub>, and CO<sub>2</sub> emission rates and type of emissions controls for utility boilers



## General Staff Air Findings

California has poor ambient air quality

- sectors, including generation, will need to improve

We have a relatively clean generation system:

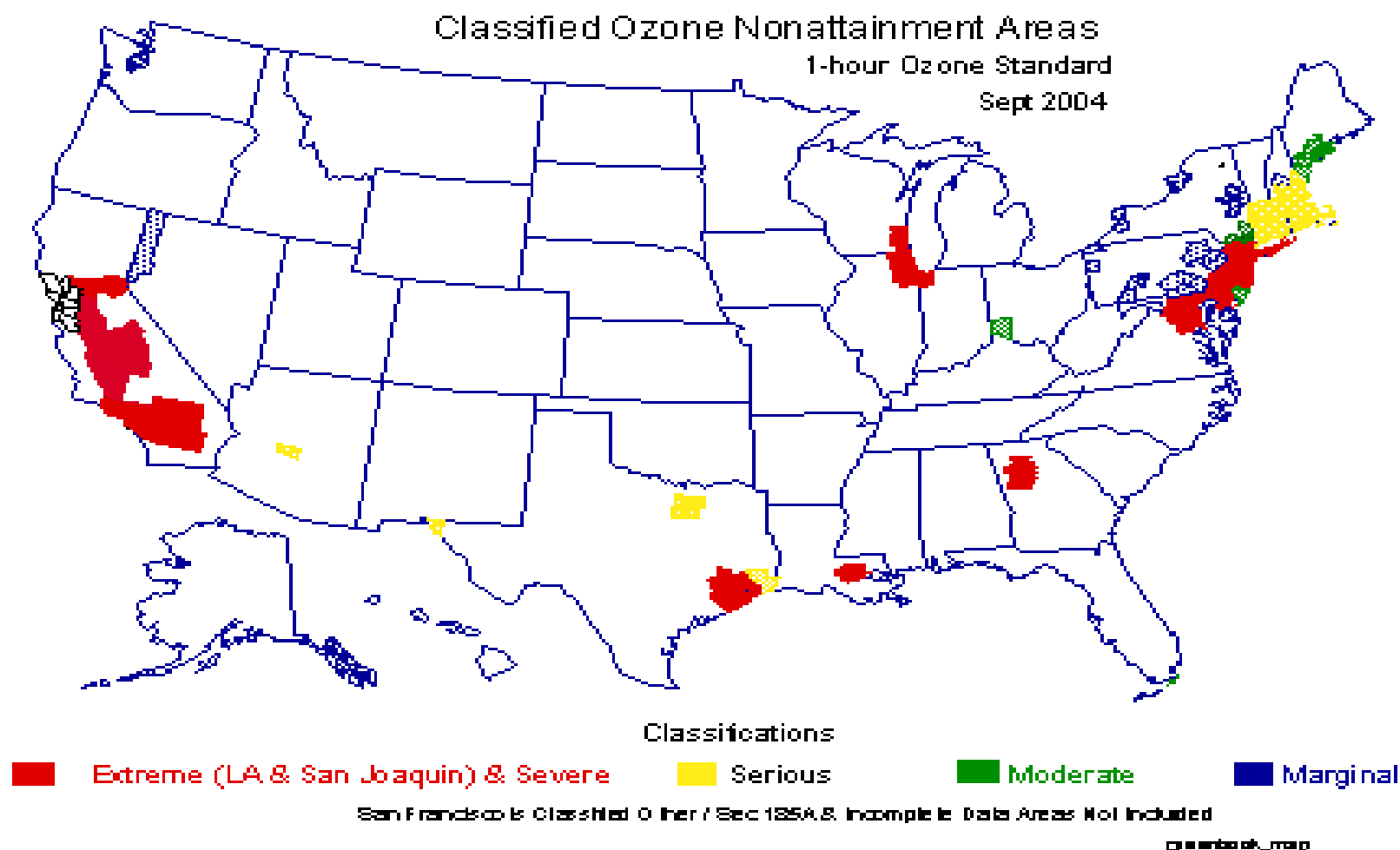
- diverse resource mix
- predominance of natural gas for the fired units
- broad use of emission controls

System averages should continue to improve:

- new resource additions are cleaner and more efficient than system averages
- implementation of emission control retrofit rules



# National Air Quality Context

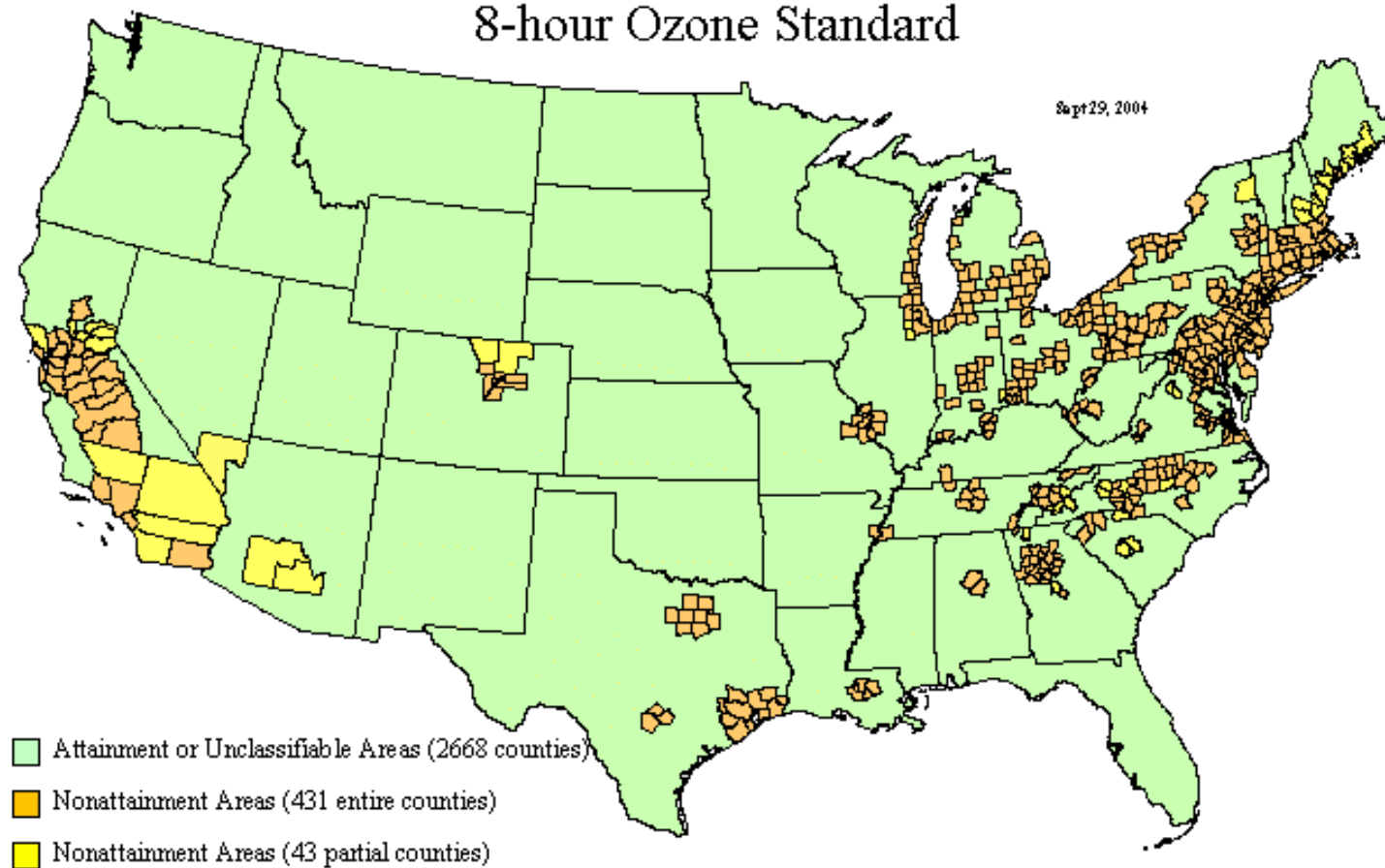


November 15, 2004

4



## Attainment and Nonattainment Areas in the U.S. 8-hour Ozone Standard

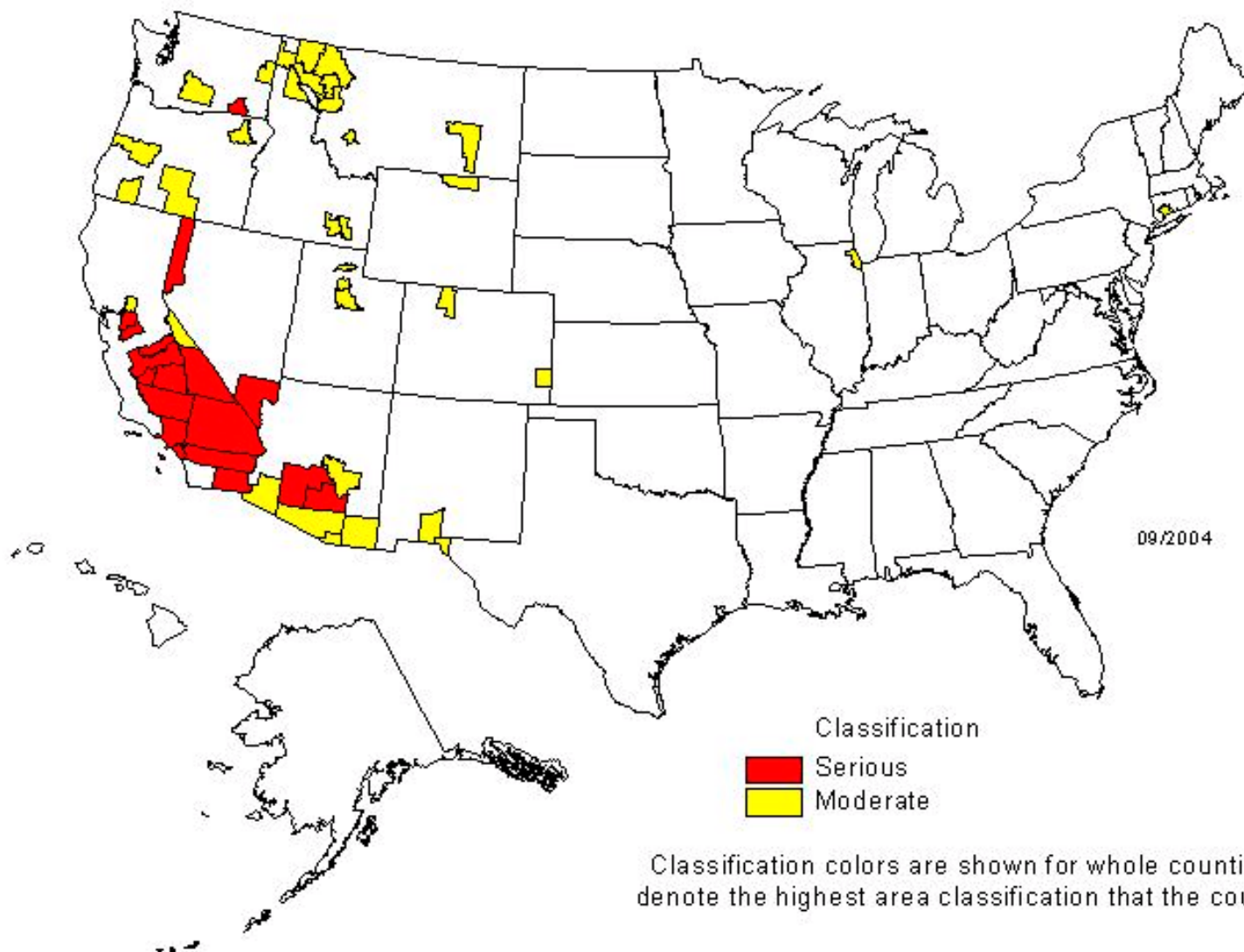


November 15, 2004

5



## Federal PM10 Non-attainment Map



November 15, 2004

6



## 2001 Environmental Performance Report - Staff Findings

- NOx and PM10 emissions and rates significantly improved from 1975 to 2000
- Emissions are concentrated in the four most developed and populated regions of California
- Local air quality strategies will continue to consider power plant emissions
- Future studies should consider:
  - distributed generation
  - PM2.5 emissions



## 2003 Environmental Performance Report - Staff Findings

- NO<sub>x</sub>, PM<sub>10</sub> and CO<sub>2</sub> emissions/rates are low:
  - use of emission controls, predominance of natural gas
  - diverse generation resource mix
  - well defined and successful air regulatory structure
- Out-of-state plants have higher emission rates:
  - higher reliance on coal
  - different ambient air quality and air regulatory settings
- Air Quality Strategies
  - continue to implement retrofit rules
  - consider retrofit rules for peakers and cogenerators





## 2004 Energy Report Update - Aging Power Plant Study - Staff Findings

The aging units, primarily utility boilers, are in compliance with air quality regulations:

- NO<sub>x</sub> emission rates much less than statewide generation averages
- PM<sub>10</sub> and PM<sub>2.5</sub> emission rates comparable to statewide generation averages
- CO<sub>2</sub> emission rates less than statewide generation averages

Air implications of retirements or replacements are uncertain.



# Generation Emissions Trends

Pollutant	Source of Emissions	1975	2000
NOx <sup>a</sup>	From All Sources (tons per day)	4,761	3,743.5
	From Power Generation (tpd)	385	124
	% Power Generation	8.1%	3.3%
	Average Emission Factor, Fuel-Fired lb/MWhr	3.3	0.66
PM10 <sup>a</sup>	From All Sources (tpd)	1,864	2,148.8
	From Power Generation (tpd)	49.6	11
	% Power Generation	2.7%	0.51%
	Average Emission Factor, Fuel-Fired lb/MWhr	0.42	0.07
PM2.5	From All Sources (tpd)	NA	848.1
	From Power Generation (tpd)	NA	10.4
	% Power Generation	NA	1.22%
	Average Emission Factor, Fuel-Fired lb/MWhr	NA	0.06

a. The 2000 values are not from the 2001 EPR. CARB has adjusted the inventories and the corrected values are reported here.

Source: 2004 Energy Report Update



# Generation CO2 Emissions Trends

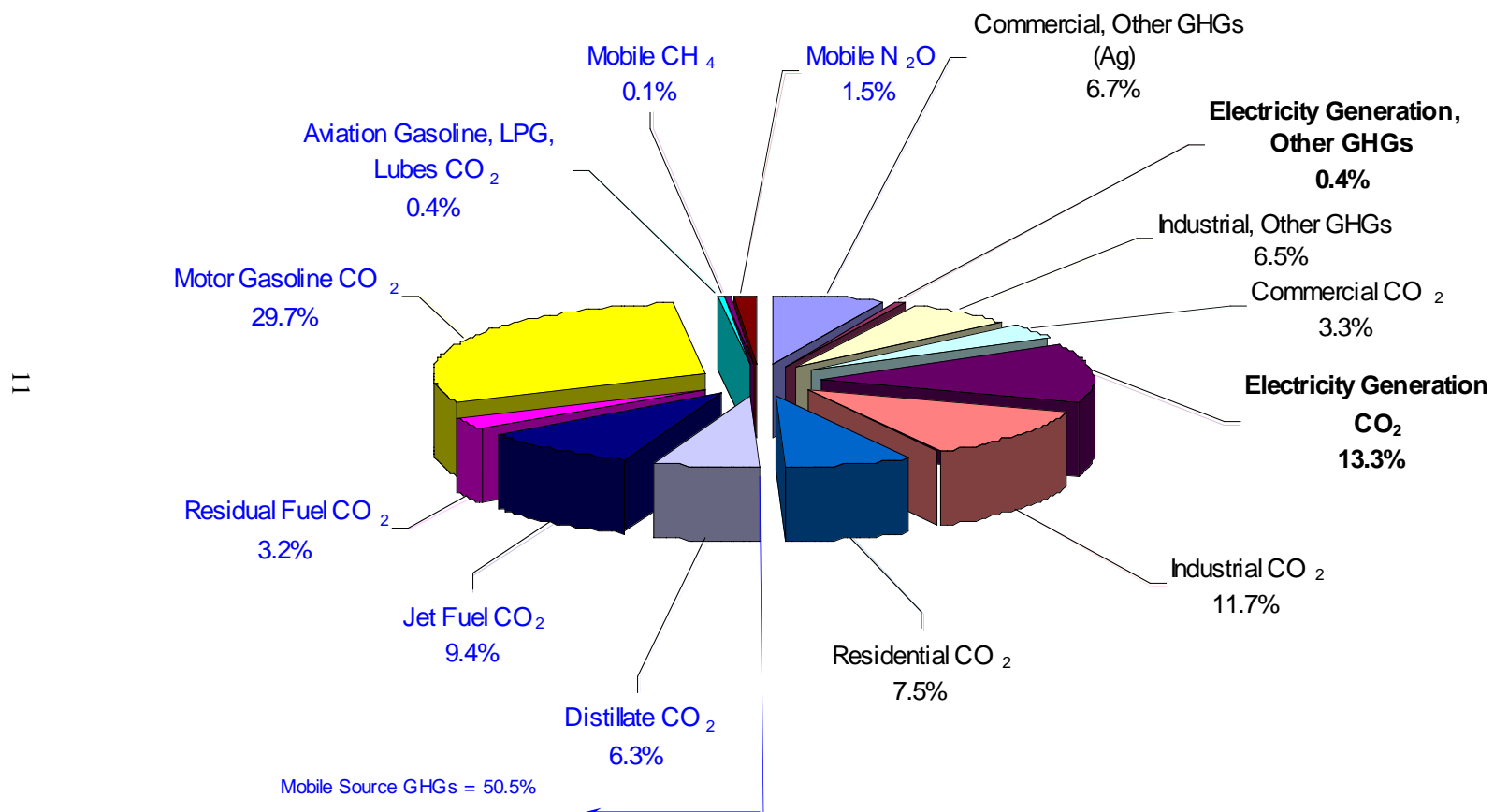
Pollutant	Source of Emissions	1999
CO2	From All Sources	381.1
	From CA Power Generation	61.0
	% Power Generation	16%
	Emission Factor (tons/MWhr)	0.71
	From Aging Power Plants	22.9
	% Aging Power plants	6.0%
	Aging Plant Emission Factor (tons/MWhr)	0.61
Inventory of California Greenhouse Gas Emissions and Sinks: 1990-1999 November 2002, Publication #600-02-001F, California Energy Commission.		

Source: 2004 Energy Report Update



# Green House Gas Emissions

California's 1999 Total GHG Emissions  
(by sector and gas)



November 15, 2004

12



# Air Emission Issues

- While the air regulations and retrofit rules can provide valuable emission reductions.....
  - are they the most cost effective reductions available?
  - can they be coordinated with other plant outages and retirements?
  - do they increase our reliance on natural gas?
- Where will the next power plants be built, and will offsets and mitigation be available?
- Will generation be a bigger relative contributor to the PM2.5 inventories than to the PM10 inventories?
- How do we evaluate emissions from out-of-state generation?



## 2005 Electricity Environmental Report - Air Topics

- Plant specific data to investigate effects of
  - location, setting and season
  - technology
  - fuel
  - dispatch and configuration (e.g., cogenerators or peakers)
- Out-of-state emission factors
- Rule and regulations
- Global Climate Change gases



# Updating the Power Plant Inventory

<b>Previous Air Studies Power Plant Inventories</b>	<b>2005 EEPR Power Plant Inventory</b>
Included approximately 675 power plants in California.	Will potentially include approximately 1,000 power plants in California.
Estimated emissions of NO <sub>x</sub> , PM <sub>10</sub> and CO <sub>2</sub> .	Will potentially estimate emissions of NO <sub>x</sub> , CO, VOC, SO <sub>x</sub> , PM <sub>10</sub> , CO <sub>2</sub> and methane.
Report included 4 sub-regions within California.	Could potentially include all air basins, air districts, and counties within California.